

Appl. No. 10/764,516
Reply to Office Action of June 14, 2007

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Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently Amended) A method for co-modelling a simulated packet network and a simulated optical network over which the simulated packet network operates, the simulated packet network representing a plurality of packet links between packet network nodes and the simulated optical network representing a plurality of optical links between optical network nodes~~operating over an optical network~~, the method comprising the steps of:
 - (1) generating a basic packet capacity comprising a capacity value for each packet link based on ~~a simulated packet network comprising~~ packet network topology information and packet traffic information; and
 - (2) generating a basic optical capacity comprising a capacity value for each optical link based on ~~a simulated packet transport network comprising~~ optical network topology information and the basic packet capacity.
2. (Currently Amended) A method for co-modelling ~~a packet network operating over an optical network~~ according to claim 1, wherein the step of generating a basic packet capacity further comprises the steps of~~[[:]]~~:
 - (1) combining the packet network topology information in the form of a packet network topology input and the packet traffic information in the form of a packet traffic matrix input to create the simulated packet network; and
 - (2) assigning each packet link of the simulated packet network a flow to create the basic packet capacity for the simulated packet network; andwherein the step of generating a basic optical capacity ~~further~~ comprises the steps of~~[[:]]~~:

Appl. No. 10/764,516

Reply to Office Action of June 14, 2007

- (3) combining the optical network topology information in the form of an optical network topology input and the basic packet capacity to form the simulated ~~packet-transport~~ optical network; and
 - (4) assigning each optical link of the simulated ~~packet-transport~~ optical network a flow to create the basic optical capacity for the simulated ~~packet-transport~~ optical network.
3. (Currently Amended) A method for co-modelling a ~~packet-network operating over an optical network~~ according to claim 2, the method further comprising the steps of[:]:
 - (1) supplying the packet network topology input;
 - (2) supplying the packet traffic matrix input; and
 - (3) supplying the optical network topology input;
4. (Currently Amended) A method for co-modelling a ~~packet-network operating over an optical network~~ according to claim 2, further comprising generating the packet network topology input, the packet traffic matrix input and the optical network topology input for use in co-modelling a ~~packet-network operating over an optical network~~ the simulated packet network and the simulated optical network over which the simulated packet network operates.
5. (Currently Amended) A method for co-modelling a ~~packet-network operating over an optical network~~ according to claim 2, wherein the packet network topology input comprises information regarding a plurality of routers in the simulated packet network, information regarding source-destination router ordered pairs in the simulated packet network, and information regarding a plurality of packet links in the simulated packet network, wherein step (2) of the method assigning each packet link of the simulated packet network a flow further comprising comprises the steps of[:]:
 - (1) setting capacity to zero for all packet links;
 - (2) performing a series of steps, as follows, for each source-destination router ordered pair;

Appl. No. 10/764,516
Reply to Office Action of June 14, 2007

- A. determining a shortest packet path between routers;
- B. establishing a source-destination packet traffic flow based on the shortest packet path; and
- C. incrementing capacity of each packet link traversed by the packet traffic flow; and

(3) increasing capacity of packet links per packet network engineering guidelines.

6. (Currently Amended) A method for co-modelling ~~a packet network operating over an optical network~~ according to claim 2, wherein the optical network topology input comprises information regarding a plurality of cross-connect switches in the simulated ~~packet transport~~ optical network and information regarding a plurality of optical links in the simulated ~~packet transport~~ optical network, wherein ~~step (4) of the method~~ assigning each optical link of the simulated optical network a flow further comprising comprises the steps of[[:]]:

(1) setting capacity to zero for all optical links;

(2) performing a series of steps, as follows, for each packet link between two routers;

- A. determining a shortest optical path between cross-connect switches supporting the two routers;
- B. establishing an optical connection to support the packet link; and
- C. incrementing capacity of each optical link traversed by the optical connection; and

(3) increasing capacity of optical links per optical network engineering guidelines.

7. (Currently Amended) A method for co-modelling ~~a packet network operating over an optical network~~ according to claim 5, wherein the optical network topology input comprises information regarding a plurality of cross-connect switches in the simulated ~~packet transport~~

Appl. No. 10/764,516
Reply to Office Action of June 14, 2007

optical network and information regarding a plurality of optical links in the simulated packet transport optical network, wherein step (4) of the method assigning each optical link of the simulated optical network a flow further comprising comprises the steps of[[:]]:

(1) setting capacity to zero for all optical links;

(2) performing a series of steps, as follows, for each packet link between two routers;

A. determining a shortest optical path between cross-connect switches supporting the two routers;

B. establishing an optical connection to support the packet link; and

C. incrementing capacity of each optical link traversed by the optical connection; and

(3) increasing capacity of optical links per optical network engineering guidelines.

8. (Currently Amended) A method for co-modelling and analyzing a simulated packet network and a simulated optical network over which the simulated packet network operates, the simulated packet network representing a plurality of packet links between packet network nodes and the simulated optical network representing a plurality of optical links between optical network nodes operating over an optical network, the method comprising the steps of[[:]]:

(1) generating a basic packet capacity comprising a capacity value for each packet link based on ~~a simulated packet network comprising~~ packet network topology information and packet traffic information; and

(2) generating a basic optical capacity comprising a capacity value for each optical link based on ~~a simulated packet transport network comprising~~ optical network topology information and the basic packet capacity; and

(3) performing analysis on the simulated packet ~~transport network and the simulated optical network over which the simulated packet network operates.~~

Appl. No. 10/764,516

Reply to Office Action of June 14, 2007

9. (Currently Amended) A method for co-modelling and analyzing ~~a packet network operating over an optical network~~ according to claim 8, wherein the step of generating a basic packet capacity further comprises the steps of[[;]]:

- (1) combining the packet network topology information in the form of a packet network topology input and the packet traffic information in the form of a packet traffic matrix input to create the simulated packet network; and
- (2) assigning each packet link of the simulated packet network a flow to create the basic packet capacity for the simulated packet network; and

wherein the step of generating a basic optical capacity ~~further~~ comprises the steps of[[;]]:

- (3) combining the optical network topology information in the form of an optical network topology input and the basic packet capacity to form the simulated ~~packet transport~~ optical network; and
- (4) assigning each optical link of the simulated ~~packet transport~~ optical network a flow to create the basic optical capacity for the simulated ~~packet transport~~ optical network.

10. (Currently amended) A method for co-modelling and analyzing ~~a packet network operating over an optical network~~ according to claim 8, wherein the step of performing analysis on the simulated packet ~~transport~~ network and the simulated optical network over which the simulated packet network operates comprises analyzing survivability of the simulated packet ~~transport~~ network and the simulated optical network over which the simulated packet network operates.

11. (Currently Amended) A method for co-modelling and analyzing ~~a packet network operating over an optical network~~ according to claim 8, wherein the step of performing analysis on the simulated packet ~~transport~~ network and the simulated optical network over which the simulated packet network operates comprises network capacity planning of the simulated packet ~~transport~~ network and the simulated optical network over which the simulated packet network operates.

Appl. No. 10/764,516

Reply to Office Action of June 14, 2007

12. (Currently Amended) A method for co-modelling and analyzing ~~a packet network operating over an optical network~~ according to claim 8, wherein the step of performing analysis on the simulated packet ~~transport~~ network and the simulated optical network over which the simulated packet network operates comprises performing survivability analysis, wherein an optical failure is known to occur within the simulated ~~packet-transport~~ optical network, the step further comprising the steps of[:]:

(1) establishing at least one protection mechanism for each point-to-point connection in the simulated packet ~~transport~~ network;

(2) performing a series of steps, as follows, for each optical link in the simulated optical network;

A. switching all affected packet traffic flow to an at least one protection mechanism;

B. incrementing capacity of each optical link traversed by the at least one protection mechanism; and

C. restoring initial capacity values; and

(3) summing capacity requirements.

13. (Currently Amended) A method for co-modelling and analyzing ~~a packet network operating over an optical network~~ according to claim 9, wherein the step of performing analysis on the simulated packet ~~transport~~ network and the simulated optical network over which the simulated packet network operates comprises performing survivability analysis, wherein an optical failure is known to occur within the simulated ~~packet-transport~~ optical network, the step further comprising the steps of[:]:

(1) establishing at least one protection mechanism for each point-to-point connection in the simulated packet ~~transport~~ network;

Appl. No. 10/764,516

Reply to Office Action of June 14, 2007

(2) performing a series of steps, as follows, for each optical link in the simulated optical network;

- A. switching all affected packet traffic flow to an at least one protection mechanism;
- B. incrementing capacity of each optical link traversed by the at least one protection mechanism; and
- C. restoring initial capacity values; and

(3) summing capacity requirements.

14. (Currently Amended) A method for analyzing survivability of a simulated packet ~~transport~~ network and a simulated optical network over which the simulated packet network operates, the simulated packet network representing a plurality of packet links between packet network nodes and the simulated optical network representing a plurality of optical links between optical network nodes ~~comprising a packet network and an optical network, wherein the packet network is operating over the optical network~~, wherein an optical failure is known to occur within the simulated packet ~~transport~~ optical network and wherein packet link protection is performed in the simulated packet network, the method comprising the steps of[[:]

(1) establishing at least one back-up packet traffic flow tunnel for each packet link in the simulated packet ~~transport~~ network;

(2) performing a series of steps, as follows, for each optical link in the simulated optical network;

- A. taking an optical link out of service;
- B. performing a series of steps, as follows, in a nested process for each packet link affected by the optical failure;
 - i. switching all packet traffic flow on the affected packet link to an at least one back-up packet traffic flow tunnel;

Appl. No. 10/764,516

Reply to Office Action of June 14, 2007

ii. incrementing capacity of each packet link traversed by the at least one back-up packet traffic flow tunnel; and

iii. incrementing capacity of each optical link traversed by an optical connection supporting the packet link; and

C. restoring initial capacity values; and

(3) summing packet link capacity requirements and optical link capacity requirements.

15. (Currently Amended) A method for analyzing survivability of a simulated packet transport network and a simulated optical network over which the simulated packet network operates, the simulated packet network representing a plurality of packet links between packet network nodes and the simulated optical network representing a plurality of optical links between optical network nodes ~~comprising a packet network and an optical network, wherein the packet network is operating over the optical network~~, wherein an optical failure is known to occur within the simulated packet transport optical network and wherein packet link protection is performed in the simulated optical network, the method comprising the steps of[:]:

(1) establishing at least one protection tunnel for each optical connection in the simulated packet transport optical network;

(2) performing a series of steps, as follows, for each optical link in the simulated optical network;

- A. taking an optical link out of service;
- B. switching all affected optical connections to an at least one protection tunnel;
- C. incrementing capacity of each optical link traversed by the at least one protection tunnel; and
- D. restoring initial capacity values; and

Appl. No. 10/764,516

Reply to Office Action of June 14, 2007

(3) summing the optical link capacity requirements.

16. (Original) The method according to claim 14, wherein the packet traffic flow is LSP (Label Switch Path) traffic flow.

17. (Currently Amended) A computer useable readable medium having computer readable ~~program code~~ executable instructions stored thereon for execution by a computer processor, for, ~~when executed, means~~ co-modelling a simulated packet network and a simulated optical network over which the simulated packet network operates, the simulated packet network representing a plurality of packet links between packet network nodes and the simulated optical network representing a plurality of optical links between optical network nodes operating over an optical network, the computer readable medium ~~program code means~~ comprising[[:]]:

- (1) ~~code means~~ computer executable instructions for generating a basic packet capacity comprising a capacity value for each packet link based on ~~a simulated packet network comprising~~ packet network topology information and packet traffic information; and
- (2) ~~code means~~ computer executable instructions for generating a basic optical capacity comprising a capacity value for each optical link based on ~~a simulated packet transport network comprising~~ optical network topology information and the basic packet capacity.

18. (Currently Amended) A computer useable readable medium having computer readable ~~program code means~~ executable instructions for ~~co-modelling a packet network operating over an optical network~~ according to claim 17, wherein ~~code means~~ the computer executable instructions for generating a basic packet capacity ~~further~~ comprise[[:]]:

- (1) computer executable instructions for combining the packet network topology information in the form of a packet network topology input and the packet traffic information in the form of a packet traffic matrix input to create the simulated packet network; and
- (2) computer executable instructions for assigning each packet link of the simulated packet network a flow to create the basic packet capacity for the simulated packet network; and

Appl. No. 10/764,516

Reply to Office Action of June 14, 2007

wherein ~~code means~~ the computer executable instructions for generating a basic optical capacity further comprise~~[[;]]~~:

- (3) computer executable instructions for combining the optical network topology information in the form of an optical network topology input and the basic packet capacity to form the simulated ~~packet-transport~~ optical network; and
- (4) computer executable instructions assigning each optical link of the simulated packet transport-optical network a flow to create the basic optical capacity for the simulated ~~packet-transport~~ optical network.

19. (Currently Amended) A computer useable readable medium having computer readable ~~program-code means~~ executable instructions for ~~co-modelling a packet network operating over an optical network~~ according to claim 18, the computer readable ~~program means~~ executable instructions further comprising~~[[;]]~~:

- (1) ~~code means~~ computer executable instructions for receiving a packet network topology input;
- (2) ~~code means~~ computer executable instructions for receiving a packet traffic matrix input; and
- (3) ~~code means~~ computer executable instructions for receiving an optical network topology input.

20. (Currently Amended) A computer useable readable medium having computer readable ~~program-code means~~ executable instructions for ~~co-modelling a packet network operating over an optical network~~ according to claim 18, further comprising computer readable ~~program-code means~~ executable instructions for generating the packet network topology input, the packet traffic matrix input and the optical network topology input for use in co-modelling a ~~packet network operating over an optical network~~ the simulated packet network and the simulated optical network over which the simulated packet network operates.

Appl. No. 10/764,516

Reply to Office Action of June 14, 2007

21. (Currently Amended) A computer ~~useable~~ readable medium having computer ~~readable~~ program code means executable instructions for co-modelling a packet network operating over an optical network according to claim 18, wherein the packet network topology input comprises information regarding a plurality of routers in the simulated packet network, information regarding source-destination router ordered pairs in the simulated packet network, and information regarding a plurality of packet links in the simulated packet network, wherein ~~item~~ (2) computer executable instructions for assigning each packet link of the simulated packet network a flow further comprises computer ~~readable program code means~~ executable instructions for[[;]]:

(1) setting capacity to zero for all packet links;

(2) performing a series of steps, as follows, for each source-destination router ordered pair;

- A. determining a shortest packet path between routers;
- B. establishing a source-destination packet traffic flow based on the shortest packet path;
- C. incrementing capacity of each packet link traversed by the packet traffic flow; and

(3) increasing capacity of packet links per packet network engineering guidelines.

22. (Currently Amended) A computer ~~useable~~ readable medium having computer ~~readable~~ program code means executable instructions for co-modelling a packet network operating over an optical network according to claim 18, wherein the optical network topology input comprises information regarding a plurality of cross-connect switches in the simulated ~~packet transport~~ optical network and information regarding a plurality of optical links in the simulated ~~packet transport~~ optical network, wherein ~~item~~ (4) computer executable instructions for assigning each optical link of the simulated optical network a flow further comprises computer ~~readable program code means~~ executable instructions for[[;]]:

Appl. No. 10/764,516
Reply to Office Action of June 14, 2007

(1) setting capacity to zero for all optical links;

(2) performing a series of steps, as follows, for each packet link between two routers;

A. determining a shortest optical path between cross-connect switches supporting the two routers;

B. establishing an optical connection to support the packet link; and

C. incrementing capacity of each optical link traversed by the optical connection; and

(3) increasing capacity of optical links per optical network engineering guidelines.

23. (Currently Amended) A computer useable readable medium having computer readable ~~program code means~~ executable instructions for ~~co-modelling a packet network operating over an optical network~~ according to claim 21, wherein the optical network topology input comprises information regarding a plurality of cross-connect switches in the simulated ~~packet transport~~ optical network and information regarding a plurality of optical links in the simulated ~~packet transport~~ optical network, wherein ~~item (4)~~ computer executable instructions for assigning each optical link of the simulated optical network a flow further comprises computer readable ~~program code means~~ executable instructions for[[;]]:

(1) setting capacity to zero for all optical links;

(2) performing a series of steps, as follows, for each packet link between two routers;

A. determining a shortest optical path between cross-connect switches supporting the two routers;

B. establishing an optical connection to support the packet link; and

Appl. No. 10/764,516
Reply to Office Action of June 14, 2007

C. incrementing capacity of each optical link traversed by the optical connection; and

(3) increasing capacity of optical links per optical-network engineering guidelines.

24. (Currently Amended) A computer useable readable medium having computer readable ~~program code means~~ executable instructions for co-modelling and analyzing a simulated packet network and a simulated optical network over which the simulated packet network operates, the simulated packet network representing a plurality of packet links between packet network nodes and the simulated optical network representing a plurality of optical links between optical network nodes operating over an optical network, the computer readable ~~program code means~~ executable instructions comprising[[:]]:

- (1) ~~code means~~ computer executable instructions for generating a basic packet capacity comprising a capacity value for each packet link based on a simulated packet network comprising packet network topology information and packet traffic information;
- (2) ~~code means~~ computer executable instructions for generating a basic optical capacity comprising a capacity value for each optical link based on a simulated packet transport network comprising optical network topology information and the basic packet capacity; and
- (3) ~~code means~~ computer executable instructions for performing analysis on the simulated packet transport network and the simulated optical network over which the simulated packet network operates.

25. (Currently Amended) A computer useable readable medium having computer readable ~~program code means~~ executable instructions for co-modelling and analyzing a packet network operating over an optical network according to claim 24, wherein code means the computer executable instructions for generating a basic packet capacity ~~further comprise~~ [[:]]:

- (1) computer executable instructions for combining the packet network topology information in the form of a packet network topology input and the packet traffic

Appl. No. 10/764,516

Reply to Office Action of June 14, 2007

information in the form of a packet traffic matrix input to create the simulated packet network; and

- (2) computer executable instructions for assigning each packet link of the simulated packet network a flow to create the basic packet capacity for the simulated packet network; and

wherein ~~code means~~ the computer executable instructions for generating a basic optical capacity further comprise;

- (3) the computer executable instructions for combining the optical network topology information in the form of an optical network topology input and the basic packet capacity to form the simulated packet-transport optical network; and

- (4) the computer executable instructions for assigning each packet link of the simulated packet-transport optical network a flow to create the basic optical capacity for the simulated packet-transport optical network.

26. (Currently Amended) A computer useable readable medium having computer readable ~~program code means~~ executable instructions for co-modelling and analyzing a packet network operating over an optical network according to claim 24, wherein ~~code means~~ the computer executable instructions for performing analysis on the simulated packet transport network and the simulated optical network over which the simulated packet network operates comprises ~~code means~~ computer executable instructions for analyzing survivability of the simulated packet transport network and the simulated optical network over which the simulated packet network operates.

27. (Currently Amended) A computer useable readable medium having computer readable ~~program code means~~ executable instructions for co-modelling and analyzing a packet network operating over an optical network according to claim 24, wherein ~~code means~~ the computer executable instructions for performing analysis on the simulated packet transport network and the simulated optical network over which the simulated packet network operates comprises ~~code means~~ computer executable instructions for network capacity planning of the simulated packet

Appl. No. 10/764,516

Reply to Office Action of June 14, 2007

transport network and the simulated optical network over which the simulated packet network operates.

28. (Currently Amended) A computer useable readable medium having computer readable ~~program code means~~ executable instructions for ~~co-modelling and analyzing a packet network operating over an optical network~~ according to claim 24, wherein ~~code means~~ the computer executable instructions for performing analysis on the simulated packet ~~transport network and the simulated optical network over which the simulated packet network operates~~ comprise ~~code means~~ computer executable instructions for performing survivability analysis, wherein an optical failure is known to occur within the simulated ~~packet transport optical~~ network, the ~~code means~~ computer executable instructions further comprising[[:]]:

(1) ~~code means~~ computer executable instructions for establishing at least one protection mechanism for each point-to-point connection in the simulated packet ~~transport~~ network;

(2) ~~code means~~ computer executable instructions for performing a series of steps, as follows, for each optical link in the simulated optical network;

- A. switching all affected packet traffic flow to an at least one protection mechanism;
- B. incrementing capacity of each optical link traversed by the at least one protection mechanism; and
- C. restoring initial capacity values; and

(3) ~~code means~~ computer executable instructions for summing capacity requirements.

29. (Currently Amended) A computer useable readable medium having computer readable ~~program code means~~ executable instructions for ~~co-modelling and analyzing a packet network operating over an optical network~~ according to claim 25, wherein ~~code means~~ the computer executable instructions for performing analysis on the simulated packet ~~transport network and the~~

Appl. No. 10/764,516

Reply to Office Action of June 14, 2007

simulated optical network over which the simulated packet network operates comprise ~~code~~ means computer executable instructions for performing survivability analysis, wherein an optical failure is known to occur within the simulated ~~packet-transport~~ optical network, the ~~code~~ means the computer executable instructions further comprising[[:]]:

(1) ~~code~~ means computer executable instructions for establishing at least one protection mechanism for each point-to-point connection in the simulated ~~packet transport~~ network;

(2) ~~code~~ means computer executable instructions for performing a series of steps, as follows, for each optical link in the simulated optical network;

- A. switching all affected packet traffic flow to an at least one protection mechanism;
- B. incrementing capacity of each optical link traversed by the at least one protection mechanism; and
- C. restoring initial capacity values; and

(3) ~~code~~ means computer executable instructions for summing capacity requirements.

30. (Currently Amended) A computer ~~useable~~ readable medium having computer ~~readable~~ program ~~code~~ means executable instructions for analyzing survivability of a simulated packet ~~transport-network~~ and a simulated optical network over which the simulated ~~packet network~~ operates, the simulated ~~packet network~~ representing a plurality of packet links between packet network nodes and the simulated ~~optical network~~ representing a plurality of optical links between optical network nodes comprising a packet network and an optical network, wherein the packet network is operating over the optical network, wherein an optical failure is known to occur within the simulated ~~packet-transport~~ optical network and wherein packet link protection is performed in the simulated packet network, the computer ~~readable-program~~ code means executable instructions comprising[[:]]:

Appl. No. 10/764,516

Reply to Office Action of June 14, 2007

(1) ~~code means~~ computer executable instructions for establishing at least one back-up packet traffic flow tunnel for each packet link in the simulated packet ~~transport~~ network;

(2) ~~code means~~ computer executable instructions for performing a series of steps, as follows, for each optical link in the simulated optical network;

A. taking an optical link out of service;

B. performing a series of steps, as follows, in a nested process for each packet link affected by the optical failure;

i. switching all packet traffic flow on the affected packet link to an at least one back-up packet traffic flow tunnel;

ii. incrementing capacity of each packet link traversed by the at least one back-up packet traffic flow tunnel; and

iii. incrementing capacity of each optical link traversed by an optical connection supporting the packet link; and

C. restoring the initial capacity values; and

(3) ~~code means~~ computer executable instructions for summing packet link capacity requirements and optical link capacity requirements.

31. (Currently Amended) A computer ~~useable~~ readable medium having computer ~~readable~~ program code means executable instructions for analyzing survivability of a simulated packet ~~transport network and a simulated optical network over which the simulated packet network operates, the simulated packet network representing a plurality of packet links between packet network nodes and the simulated optical network representing a plurality of optical links between optical network nodes comprising a packet network and an optical network, wherein the packet network is operating over the optical network,~~ wherein an optical failure is known to occur within the simulated ~~packet transport~~ optical network and wherein packet link protection is

Appl. No. 10/764,516

Reply to Office Action of June 14, 2007

performed in the simulated optical network, the computer ~~readable program code means~~ executable instructions comprising[[:]]:

(1) ~~code means~~ computer executable instructions for establishing at least one protection tunnel for each optical connection in the simulated ~~packet transport~~ optical network;

(2) ~~code means~~ computer executable instructions for performing a series of steps, as follows, for each optical link in the simulated optical network;

- A. taking an optical link out of service;
- B. switching all affected optical connections to an at least one protection tunnel;
- C. incrementing capacity of each optical link traversed by the at least one protection tunnel; and
- D. restoring initial capacity values; and

(3) ~~code means~~ computer executable instructions for summing the optical link capacity requirements.

32. (Currently Amended) The computer ~~useable~~ readable medium having a computer ~~readable program code means~~ executable instructions according to claim 30, wherein the packet traffic flow is LSP (Label Switch Path) traffic flow.